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(54) **TABLET PRESS MACHINE**

TABLETTIERUNGSMASCHINE

APPAREIL DE PRESSE À COMPRIMÉS

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Description

[0001] The present invention relates to tablet press machines for producing tablets, lozenges, pills, for example for pharmaceutical, cosmetic, food, chemical use, by compressing a powdered or granular product. In particular, the invention relates to a rotary tablet press machine.

[0002] The known rotary tablet press machines comprise a compression turret, rotating about a vertical axis and formed by a die table or plate provided with a plurality of dies, i.e. through cavities, angularly distributed, equidistant from each other, along a circumferential portion of the table and arranged to receive a powdered or granular product delivered in a suitable dosing station. The turret further comprises a plurality of upper punches and lower punches associated in pairs with the respective dies and moved linearly and vertically, coaxially to the dies, by cams and compression rollers during the rotation of the turret. The cams and compression rollers are in fact connected to a fixed supporting structure of the tablet press machine which also rotatably supports the turret.

[0003] The lower punches form with the dies apposite seats or dosing chambers adapted to receive the product in the dosing station where the product is inserted into the dies closed at the bottom by the lower punches. After filling, a scraper in contact with the upper surface of the die table removes the excess dosed product from the dies.

[0004] In a successive compression station the upper punches and lower punches are moved by compression rollers to compress the product inserted into the dies so as to create the tablets, which are then extracted from the dies of the table by means of the lower punches, suitably lifted, and then conveyed in an outlet chute.

[0005] The various tablet manufacturing steps are performed during one rotation revolution of the compression turret which rotates with continuous motion.

[0006] In the dosing station the lower punches are moved by a filling or loading cam so as to form, in the respective die, dosing chambers having a predefined volume which allows to obtain tablets having settled dimensions and weight after the compression. The filling cam is fixed and interchangeable with other filling cams so as to vary the position of the lower punch in the die and thus the volume of the dosing chamber.

[0007] The interchangeable filling cams allow to vary in discrete manner, i.e. according to a definite and distinct number, the position of the lower punches and therefore the volume of the dosing chamber within a definite range. Therefore the interchangeable filling cams do not allow an almost continuous adjustment of the volume within such a range.

[0008] Indeed, for economic and practical reasons, manufacturers of tablet press machines generally provide as standard equipment a limited number of interchangeable filling cams of different sizes in order to obtain the most common volumes of the dosing chambers, i.e. the size and weight of the tablets.

[0009] Discrete variation of a quantity means that between one value and the next there is a set interval, while continuous variation of a quantity means that between one value and the next there are no interval or, in practice, a very small interval.

[0010] In order to obtain intermediate and/or more precise adjustments of the volume of the dosing chamber in some tablet press machines, suitable adjustment cams are provided downstream of the filling cams, with reference to the rotation direction of the turret, which allow to modify, in particular reduce, the volume of the dosing chambers by appropriately raising the lower punches to remove the excess product at the end of the dosing step.

[0011] A disadvantage of the aforementioned known tablet press machines lies in the fact that the volume adjustment operations of the dosing chambers require the replacement of the filling cams and sometimes of the adjustment cams and are therefore quite complex and laborious, resulting in long stopping times of the tablet press machine and therefore of production.

[0012] Furthermore, interchangeable filling cams and adjustment cams do not always guarantee to obtain a desired dosage volume, this requiring construction of expensive custom cams.

[0013] Finally, the precise adjustment by means of the adjustment cams, since it involves the removal of the excess product from the dies, in some cases is not acceptable to the user of the tablet press machine, who cannot reuse the removed product for producing new tablets (for the risk of possible mixing problems due to density variation within the feeding system), but must discard it, resulting in increased production costs.

[0014] US 5762978 discloses a batching device that can be applied to compression machines including a turret, rotating around a vertical axis and fitted with a series of die holes aimed at being filled with powder of granular material, a pairs of upper and lower punches, related to each die hole and guided slidably in the turret for engaging the die holes with respective counterfacing working heads. The device comprises a driving cam that drives at least one of the punches and determines the reciprocal distance between the working heads of each pair of punches, in the material batching step and in the material loading step. The driving cam moves axially with respect to the turret so as to adjust this distance. Further cams are provided for completion of guiding structure with variable profile, which facilitates entering in the driving cam. The cams are mechanically linked to each other, so as to change the profile in accordance with adjusting position of the driving cam.

[0015] US 2007/257411 discloses a device for guiding lower punches over a lower-punch head in a rotary pelleting press near a filling device with a rotor and a die-plate. The rotor has a die-plate with drilled holes for each pair of upper and lower punches to work together. The filling device feeds powder to be pressed into the drilled holes as the drilled holes run along on the filling device.

The lower punches have a position, which set a filling capacity in advance. During the filling process, the lower punches move with their heads along a feeder camplate.

[0016] An object of the present invention is to improve the known tablet press machines, in particular the rotary tablet press machines having a compression turret provided with dies and upper and lower punches.

[0017] Another object is to provide a tablet press machine, which allows a volume of dosing chambers, which are formed by dies and lower punches in a dosing station of a product to be compressed, to be adjusted in a simple, fast and precise manner, without manual intervention by operators.

[0018] A further object is to produce a tablet press machine, which allows an substantially continuous adjustment or variation of the volume of the dosing chambers.

[0019] Still another object is to provide a tablet press machine, which allows dosing in a precise and accurate manner a product to be compressed inside the dies without the need to remove excess product from the dies at the end of a dosing step.

[0020] The invention can be better understood and implemented with reference to the attached drawings which illustrate an exemplary and non-limiting embodiment thereof, in which:

- figure 1 is a schematic, partial view on a plane of a rotary tablet press machine according to the invention, illustrating in particular a dosing station of a product;
- figure 2 is an enlarged and partial view of figure 1 illustrating lower punches and cam means of the dosing station in a configuration of maximum filling of the product;
- figure 3 is a section according to the plane III-III of figure 2;
- figure 3A is an enlarged detail of figure 3;
- figure 4 is a perspective view of the cam means of the dosing station and related driving means;
- figures 5 and 6 are respectively a front view and a top plan view of the cam means and driving means of figure 4;
- figure 7 is a view similar to that of figure 2 that shows the lower punches and the cam means in a first configuration of intermediate filling;
- figure 8 is a section according to the plane VIII-VIII of figure 7;
- figure 9 is a view similar to that of figure 2 which shows the lower punches and the cam means in a second configuration of intermediate filling;
- figure 10 is a section according to the plane X-X of figure 9;
- figure 11 is an enlarged and interrupted perspective view of the cam means in the second configuration of intermediate filling;
- figure 12 is a plan view of the cam means of figure 11;
- figure 13 is a view similar to that of figure 2 which shows the lower punches and the cam means in a configuration of minimum filling;
- figure 14 is a section according to the plane XIV-XIV of figure 14.

[0021] With reference to figures 1 to 6, a rotary tablet press machine 1 according to the invention is illustrated, that is arranged to produce tablets, lozenges, pills by compressing a product 50 in powder or granules for pharmaceutical, cosmetic, food or chemical use.

[0022] The tablet press machine 1 comprises a compression turret 2 which is rotatable about an rotation axis X, in particular vertical, according to a rotation direction R and which includes a die table 3, provided along a circumferential portion or edge thereof with a plurality of dies 4, a plurality of lower punches 5 and a corresponding plurality of upper punches 6 associated in pairs with respective dies 4 and movable along a first direction T in order to compress the product 50 inserted into the dies 4 so as to obtain tablets, lozenges or pills.

[0023] The dies 4 are through cavities made in the die table 3 that form in cooperation with the punches 5, 6 the seats or housings in which the product 50 is dosed and subsequently compressed to form the tablets 100.

[0024] The tablet press machine 1 comprises a dosing station 7 arranged to dispense a fixed amount of product 50 to be compressed inside the dies 4 and at least one compression station, of a known type and not illustrated in the figures, in which the lower punches 5 and the upper punches 6 are linearly moved inside the respective dies 4 to compress the product 50 delivered into the dies 4 so as to obtain the tablets.

[0025] The dosing station 7 comprises filling means 8 arranged to fill with the product 50 dosing cavities 40 formed by the dies 4 closed at the bottom by the lower punches 5 and having an settled filling depth L1 and cam means 10 cooperating with the lower punches 5 to move the latter ones inside the respective dies 4 and obtain the settled filling depth L1. Cam means 10 are fixed with respect to the compression turret 2 and are connected to a fixed supporting structure 30 of the tablet press machine 1.

[0026] In the illustrated embodiment, the filling means 8 comprise a container 38 containing the product 50 and open on the die table 3 to allow the product 50 to penetrate into the dosing cavities 40 in the respective dies 4.

[0027] The depth or height of the dosing cavities 40 increases progressively during the rotation of the compression turret 2 in the rotation direction R, from a substantially zero value, when the dies 4, with the respective upper ends 16 of the lower punches 5 inserted therein, enter the container 38, to a value equal to the settled filling depth L1 when exiting the container 38. Downstream of the container with reference to the rotation direction R of the compression turret 2 a scraper element is provided, of a known type and not illustrated in the figures, which is in sliding contact with an upper surface of the die table 3 in order to remove possible excess product 50 dosed in the dies 4.

[0028] The cam means 10 comprise a first filling cam 21 provided with a first channel 25 and a second filling cam 22 provided with a second channel 26, said first channel 25 and said second channel 26 being configured and mutually arranged so as to guide follower ends 15 of the lower punches 5 along a filling profile or channel 27 defined by said first and second channel 25, 26. The second channel 26 is opposite the first channel 25 with respect to the lower punches 5.

[0029] The tablet press machine 1 further comprises a first adjustment element 11 supporting the first filling cam 21 and a second adjustment element 12 supporting the second filling cam 22, which is mounted on said second adjustment element 12 slidably along an arc of circumference about the rotation axis X of the compression turret 2. The first filling cam 21 is mounted fixed on the first adjustment element 11.

[0030] The first adjustment element 11 is slidably fixed to a supporting element 35 of the fixed supporting structure 30 of the tablet press machine 1.

[0031] The second adjustment element 12 is configured to be moved with respect to the first adjustment element 11 along a first direction T parallel to the rotation axis X of the compression turret 2. In particular, the second adjustment element 12 is associated with and movably mounted with respect to the first adjustment element 11 along the first direction T. The tablet press machine 1 further comprises first driving means 13 configured to move with respect to the compression turret 2 and along the first direction T simultaneously the first adjustment element 11 supporting the first filling cam 21 and the second adjustment element 12 slidably supporting the second filling cam 22.

[0032] The first filling cam 21 is the inner cam, i.e. the closest one to the rotation axis X, and the first channel 25 is therefore made on an outer side wall 21a of the first filling cam and open towards the outside of the tablet press machine 1. The second filling cam 22 is the outer cam, i.e. the farthest one from the rotation axis X, and the second channel 26 is therefore made on an inner side wall 22a of the second filling cam and open towards the inside of the tablet press machine 1.

[0033] The second filling cam 22 is further movable on, and along, the second adjustment element 12, rotating about the rotation axis X at least between a closed position B, in which it is substantially opposite the first filling cam 21 with the first channel 25 facing the second channel 26, and an open position A, in which said second filling cam 22 is positioned angularly spaced from, in particular adjacent to and immediately downstream of, said first filling cam 21, with reference to the rotation direction R. The second filling cam 22 is slidably supported by a supporting plane 12a of the second adjustment element 12.

[0034] As better explained in the following description, by suitably moving the first adjustment element 11, the second adjustment element 12 and the second filling cam 22 with respect to each other in a plurality of different filling configurations it is possible to vary profile and length of the filling channel 27 as desired. Therefore it is possible to vary the position of lower punches 5 in the dies 4, during the rotation of the compression turret 2, and to vary the filling depth of the dosing chambers 40 in the respective dies 4 according to the required specifications, in particular to change the value of the filling depth between a maximum value L1 and a minimum value L4 in an almost continuous manner, i.e. with a very small interval between one value and the next, for example equal to about 0,01 mm.

[0035] The first channel 25 of the first filling cam 21 comprises a first upper track 25a and a first lower track 25b, and the second channel 26 of the second filling cam 22 comprises a second upper track 26a and a second lower track 26b, said first tracks 25a, 25b and second tracks 26a, 26b being configured to abut and guide the follower ends 15 of the lower punches 5. The first channel 25, further comprises a first section 31 and a second section 32.

[0036] In the first section 31, the first channel 25 is converging having a width or height, i.e. a distance between the first upper track 25a and the first lower track 25b, that decreases in the rotation direction R. More precisely, the first channel 25 in the first section 31 has a first inlet height d1 (i.e. an inlet distance between the first upper track 25a and the second lower track 25b) such as to allow the follower ends 15 to selectively abut the first upper track 25a or the first lower track 25b, according to the position of the first filling cam 21, i.e. of the first adjustment element 11 along the first direction T, and a first outlet height d2 such as to maintain the follower ends 15 abutting substantially both first tracks 25a, 25b.

[0037] The inlet height d1 of the first channel 25 is bigger than an operating height h of the follower end 15 of the lower punch 5 to allow said follower end 15 to selectively abut the first upper track 25a or the first lower track 25b.

[0038] In the second section 32, positioned downstream of the first section 31 with reference to the rotation direction R, the first channel 25 has a width or height, i.e. a distance between the second upper track 26a and the second lower track 26b, which is substantially constant and equal to the first outlet height d2 in the first section 31.

[0039] The first upper track 25a in both sections 31, 32 is substantially straight and sloping towards, i.e. approaching, the first lower track 25b according to the rotation direction R of a predefined angle, in particular at the first section 31. The first lower track 25b is substantially perpendicular to the rotation axis X, in particular straight and horizontal, at the first section 31, while it is inclined with respect to the rotation axis X and parallel to the first upper track 25b at the second section 32.

[0040] In the embodiment illustrated in the figures (figure 2), the first upper track 25a forms an inclination angle α with the supporting plane 12a of the second adjustment element 12, for example equal to about 5° (degree).

[0041] Likewise, the second channel 26 comprises a further first section 33 and a further second section 34. In the further first section 33 the second channel 26 is converging since has a width or height, i.e. a distance between the second upper track 26a and the second lower track 26b, decreasing in the rotation direction R. More precisely, in the further first section 33 the second channel 26 has a second inlet height or distance d1' such as to allow the follower ends 15 to selectively abut the second upper track 26a or the second lower track 26b, according to the angular position of the second filling cam 22 on the second adjustment element 12 and the position of the latter along the first direction T, and a second outlet height or distance d2' such as to maintain the follower ends 15 abutting substantially both second tracks 26a, 26b. In the further second section 34, positioned downstream of the further first section 33 with reference to the rotation direction R, the second channel 26 has a distance between the second upper track 26a and the second lower track 26b substantially constant and equal to the second outlet height d2'.

[0042] The second upper track 26a in both further sections 33, 34 is substantially straight and inclined with a slope towards, i.e. approaching, the second lower track 26b according to the rotation direction R, in particular at the further first section 33, and the second lower track 26b is substantially perpendicular to the rotation axis X, in particular straight and horizontal, at the further first section 33 while it is inclined with respect to the rotation axis X and parallel to the second upper track 26a at the further second section 34.

[0043] In the illustrated embodiment, the first upper track 25a and the second upper track 26a are inclined with respect to the supporting plane 12a of the adjustment element 12 of the same inclination angle α.

[0044] In the illustrated embodiment the inlet heights or distances d1, d1' and the outlet heights or distances d2, d2' respectively between the first tracks 25a, 25b of the first channel 25 and between the second tracks 26a, 26b of the second channel 26 are the same, and the first channel 25 and the second channel 26 are substantially the same and specular with respect to the lower punches, in particular with respect to a cylindrical geometric surface M passing through the longitudinal axes Y of the lower punches 5.

[0045] The first driving means 13 are configured to move, with respect to the compression turret 2 and along the first direction T, the first adjustment element 11 (supporting the first filling cam 21 and the second adjustment element 12, which in turn slidably supports the second filling cam 22), in a plurality of positions between a raised position C and a lowered position D.

[0046] In the illustrated example, in the raised position C, the first lower track 25b of the first channel 25 of the first filling cam 21 is arranged to abut and slidably guide the follower ends 15 of the lower punches 5, and in the lowered position D, the first upper track 25a of the first channel 25 of the first filling cam 21 is arranged to abut and slidably guide the follower ends 15. The first driving means 13 are thus capable of moving the first filling cam 21 along a stroke of length S in a plurality of different working positions (figure 3A).

[0047] The first driving means 13 comprise a first rotary electric motor 45 and first transmission means 41, for example of the screw-nut screw type, actuated by the said first electric motor 45 to linearly move the first adjustment element 11 along the first direction T. The first transmission means 41 comprise a nut screw fixed to the first adjustment element 11 and coupled with, and linearly moved by, a screw rotated by the first rotary electric motor 45. The first adjustment element 11 is also slidably coupled to the supporting element 35 of the fixed supporting structure 30 by means of a pair of rods 44.

[0048] The tablet press machine 1 also comprises second driving means 14 configured to move by second transmission means 48 the second adjustment element 12 with respect to said first adjustment element 11 along the first direction T and autonomously with respect to said first adjustment element 11.

[0049] Preferably, the second driving means 14 are further configured to move through third transmission means 51, in a coordinated manner with respect to the first filling cam 21, the second filling cam 22 slidably above and along the second adjustment element 12 and in rotation about the rotation axis between the said open position A and said closed position B. In this manner, the second upper track 26a of the second channel 26 is held parallel and coplanar to the first upper track 25a of the first channel 25. Coplanar means that the upper tracks 25a, 26a are consecutive and adjacent as well as inclined with respect to the supporting plane 12a of the second adjustment element 12 of the same inclination angle α as the upper tracks 25, 26.

[0050] The second driving means 14 comprise, for example, a second rotary electric motor 47, the second transmission means 48 and the third transmission means 51 being actuated by the second electric motor 47 respectively to linearly move the second adjustment element 12 along the first direction T and to move the second filling cam 22 on the first adjustment element 12 along an arc of circumference whose centre is on the rotation axis X.

[0051] The second transmission means 48 are, for example, of the screw-nut screw type and comprise respectively a nut screw fixed to the second adjustment element 12 and coupled with, and linearly moved by, a respective screw rotated by the second rotary electric motor 47 through an extendable cardan joint 49.

[0052] The third transmission means 51 comprise, for example, a toothed sector that is made on the second filling cam 22, in particular on an outer side wall thereof that is opposite the inner side wall 22a, and engages, i.e. is in mesh, with a pinion 52 rotated by the second rotary electric motor 47 of the second driving means 14. The gear ratio between toothed sector and pinion 52 and transmission ratio between screw-nut screw of the second transmission means 48 are such as to allow the second filling cam 22 to be moved between the open position A and the closed position B while always maintaining the second upper track 26a parallel and coplanar to the first upper track 25a of the first filling cam 21.

[0053] With particular reference to figure 3A, the follower end 15 of each lower punch 5 comprises a shaped annular protrusion, in particular having said operating height h, provided with opposite annular abutment faces 15a, 15b arranged to abut slidably the upper tracks 25a, 26a and/or the lower tracks 25b, 26b of the first and second channel 25, 26. The annular faces are inclined with respect to a longitudinal axis Y of the lower punch 5 of the same inclination angle as the sliding surfaces of the upper 25a, 26a and lower 25b, 26b tracks. The operating height h is the distance along the longitudinal axis Y between the upper and lower edges of the annular abutment faces 15a, 15b.

[0054] In a variant of the tablet press machine 1 of the invention not illustrated, the follower end 15 of each lower punch 5 comprises a pair of opposite rotating rollers with respect to the longitudinal axis Y and arranged to abut the upper tracks 25a, 26a and/or the lower tracks 25b, 26b of the first and second channel 25, 26.

[0055] The tablet press machine 1 further comprises a fixed inlet cam 9 positioned upstream of the first filling cam 21 with reference to the rotation direction R and provided with an inlet track 28 adapted to support and slidably guide the follower ends 15 of the lower punches 5 at the inlet of the dosing station 7 towards the first channel 25 of the first filling cam 21. The inlet path 28 has a substantially linear and horizontal profile.

[0056] The second adjustment element 12 comprises an outlet track 29 adapted to support and slidably guide the follower ends 15 of the lower punches 5 exiting the second filling cam 22 and having a substantially linear and horizontal profile.

[0057] To this end, the follower ends 15 of the lower punches 5 comprise respective base faces 15c arranged to abut the inlet and outlet tracks 28, 29.

[0058] It should be noted that a filling distance F between the upper surfaces of the inlet track 28 and the outlet track 29 respectively, is the filling stroke of the lower punches 5 to form dosing chambers 40 in the dies 4 having the desired filling depth.

[0059] Referring to figures 2 to 14 in an initial adjustment step of the tablet press machine 1 of the invention, it is provided the adjustment of cam means 10 to set the filling distance F, i.e. the stroke of the lower punches 5, so as to obtain dosing chambers 40 in the dies 4 having an settled and desired filling depth.

[0060] More precisely, the first filling cam 21 and the second filling cam are positioned with respect to each other so that the first channel 25 and the second channel 26 form a filling profile or channel 27 having a length and profile such as to carry out the required displacement of the lower punches 5 to obtain the required filling depth.

[0061] To this end, the first adjustment element 11 supporting both filling cams 21, 22 is moved with respect to the compression turret 2 by the first driving means 13 along the first direction T and arranged at a fixed position between the possible positions comprised between the raised position C and the lowered position D. At the same time, the second adjustment element 12 and the second filling cam 22 are moved with respect to the first filling cam 21 by the second driving means 14 in a coordinated manner respectively along the first direction T and along the second adjustment element 12 and about the rotation axis X of the compression turret 2, so as to position the second filling cam 22 at a respective settled position among the possible positions comprised between the open position A and the closed position B. Several combinations of the relative positions between the filling cams 21, 22 and the positions of filling cams, i.e. of the first adjustment element 11, with respect to the compression turret 2 can be used to achieve a same filling distance F or filling depth.

[0062] Figures 2-14 illustrate some filling configurations of the cam means 10 obtained by combining the relative positions of the filling cams 21, 22 arranged in the respective end positions, i.e., in the raised positions C and lowered positions D for the first filling cam 21 and in the open and closed positions A, B for the second filling cam 22.

[0063] Figures 1 to 6 illustrate a configuration of maximum filling C1 of cam means 10 which allows to obtain the maximum filling depth L1 of the dosing chamber 40. In such a configuration of maximum filling C1, the first filling cam 21 fixed and moved by the first adjustment element 11 is arranged in the lowered position D and the second filling cam 22, slidably supported by the second adjustment element 12, is arranged in the open position A, creating a filling profile 27 having a maximum length.

[0064] In the configuration of maximum filling C1 the follower ends 15 of the lower punches 5 during the rotation of the compression turret 2 abut and are slidably guided by the upper tracks 25a, 26a, in particular at the respective first sections 31, 33 of the channels 25, 26 of the filling cams 21, 22. The filling distance F between the sliding surfaces of the inlet track 28 and the outlet track 29 is equal to the maximum filling depth L1.

[0065] Figures 7 and 8 illustrate a first configuration of intermediate filling C2 of cam means 10 which allow to obtain a first intermediate filling depth L2 of the dosing chamber 40. In such a first configuration of intermediate filling C2, the first filling cam 21 is arranged in the raised position C and the second filling cam 22 is held in the open position A, creating a filling channel 27 having maximum length.

[0066] In the first configuration of intermediate filling C2 the follower ends 15 of the lower punches 5 during the rotation of the compression turret 2 in the first section 31 of the first channel 25 of the first filling cam 21 abut and are slidably guided by the first lower tracks 25b, while in the further first section 33 of the second channel 26 of the second filling cam 22 they abut and are guided by the second upper track 26a.

[0067] The filling distance F between the sliding surfaces of the inlet track 28 and the outlet track 29 is equal to the first intermediate filling depth L2.

[0068] Figures 9 to 12 illustrate a second configuration of intermediate filling C3 of cam means 10 which allows to obtain a second intermediate filling depth L3 of the dosing chamber 40, smaller than the first intermediate filling depth L2. In such a second configuration of intermediate filling C3, the first filling cam 21 is arranged in the lowered position D and the second filling cam 22 is arranged in the closed position B, creating a filling channel 27 having a minimum length.

[0069] In this second configuration of intermediate filling C3 the second channel 26 of the second filling cam 22 is facing in a substantially specular way the first channel 25 of the first filling cam 21 and the follower ends 15 of the lower punches 5 during the rotation of the compression turret 2 in the first sections 31, 33 of the channels 25, 26 of the filling cams 21, 22 abut and are slidably guided by both upper tracks 25a, 26a.

[0070] The filling distance F between the upper sliding surfaces of the inlet track 28 and the outlet track 29 is equal to the second intermediate filling depth L3.

[0071] Figures 13 and 14 illustrate a configuration of minimum filling C4 of cam means 10 which allows to obtain the minimum filling depth L4 of the dosing chamber 40. In such a configuration of minimum filling C4, the first filling cam 21 is arranged in the raised position C and the second filling cam 22 is arranged in the closed position B, creating a filling channel 27 having a minimum length.

[0072] In the configuration of minimum filling C4 the second channel 26 of the second filling cam 22 is facing in a substantially specular way the first channel 25 of the first filling cam 21 and the follower ends 15 of the lower punches 5 during the rotation of the compression turret 2 in the first sections 31, 33 of the channels 25, 26 of the respective filling cams 21, 22 abut and are slidably guided by the lower tracks 25b, 26b.

[0073] The filling distance F between the sliding surfaces of the inlet track 28 and the outlet track 29 is equal to the minimum filling depth L4.

[0074] As already highlighted above, by suitably moving the first adjustment element 11, i.e. the first filling cam 21 with respect to the compression turret 2 along the adjustment direction T, and the second filling cam 22 parallel and about the rotation axis X with respect to the first filling cam 21, it is possible to rapidly, simply and precisely obtain a plurality of different configurations of filling comprised between the configuration of maximum filling C1 and the configuration of minimum filling C4, i.e. it is possible to vary and adjust the filling depth from the maximum value L1 to the minimum value L2 in an almost continuous manner, with a minimum interval, for example equal to about 0.01 mm between one value and the next. Such an adjustment can be performed accurately and quickly by the driving means 13, 14 comprising two rotary electric motors 45, 47 controllable in rotation and speed with precision.

[0075] The range of values between the maximum value L1 and the minimum value L2 may be, for example, about 14 mm, considering, for example, a maximum filling depth value L1 of 20 mm and a minimum filling depth value of 6 mm. This range of 14 mm can be obtained in traditional rotary filling machines by replacing the filling cam and necessarily using a suitable adjustment cam positioned downstream of the filling cam to obtain intermediate and/or more precise adjustments of the volume of dosing chamber 40. The adjustment cam allows to modify, in particular to reduce, the volume of dosing chambers 40, to bring the volume to the desired value, by suitably raising the lower punches 5 so as to allow the removal of the excess product.

[0076] Thanks to cam means 10 of tablet press machine 1 of the invention, which allow a precise and accurate adjustment of the volume of dosing chambers 40 obtained in the dies 4 with the lower punches 5, it is not necessary to include a subsequent downstream adjustment cam in order to reduce the volume of dosing chambers 40, this making it possible to simplify the structure of the tablet press machine 1.

[0077] Moreover, since it is not necessary to replace the filling cams 21, 22 in order to vary the filling depth within the settled range of values L1-L4, the stopping times of the filling machine 1 of the invention are minimal, also due to the easy and fast adjustment of the position of filling cams 21, 22 by the driving means 13, 14.

Claims

1. Rotary tablet press machine (1) comprising:

- a compression turret (2) rotating with a rotation direction (R) about a rotation axis (X) and including a die table (3), provided along a circumferential portion thereof with a plurality of dies (4), a plurality of lower punches (5) and a corresponding plurality of upper punches (6) associated in pairs with respective dies (4);
- a dosing station (7) comprising filling means (8) for filling with a product (50) dosing cavities (40) that are formed by said dies (4) closed at the bottom by said lower punches (5) and have a settled filling depth (L1, L2, L3, L4) and
- cam means (10) cooperating with said lower punches (5) for moving the lower punches inside the respective dies (4) and obtaining said settled filling depth (L1, L2, L3, L4), wherein said cam means (10) comprise a first filling cam (21) provided with a first channel (25) and a second filling cam (22) provided with a second channel (26), said first channel (25) and said second channel (26) being configured and mutually arranged to guide follower ends (15) of said lower punches (5) along a filling channel (27);

characterized in that it comprises:

- a first adjustment element (11) supporting said first filling cam (21) and a second adjustment element (12) supporting said second filling cam (22), which is mounted on said second adjustment element (12) slidably along an arc of circumference about said rotation axis (X), said second adjustment element (12) being configured to be moved with respect to said first adjustment element (11) along a first direction (T) parallel to said rotation axis (X);
- first driving means (13) configured to move with respect to said compression turret (2) and along said first direction (T) simultaneously said first adjustment element (11) supporting said first filling cam (21) and said second adjustment element (12) slidably supporting said second filling cam (22); and
- second driving means (14) configured to move, with respect to said first filling cam (21), said second adjustment element (12) and said second filling cam (22) in a coordinated manner respectively along the first direction (T) and along the second adjustment element (12) and about said rotation axis (X);

wherein said first filling cam (21) and said second filling cam (22) are configured to be positioned with respect to each other by said first driving means (13) and said second driving means (14) so that said first channel (25) and said second channel (26) form said filling channel (27) having a length and a profile such as to carry out the required displacement of the lower punches (5) to obtain said settled filling depth (L1, L2, L3, L4) and wherein said first channel (25) at an end thereof for entry of the lower punch (5) has an inlet height (d1) bigger than an operating height (h) of said follower end (15) of the lower punch (5).

2. Tablet press machine (1) according to claim 1, wherein said second filling cam (22) is movable at least between a closed position (B), in which it is substantially opposite said first filling cam (21) with the first channel (25) facing the second channel (26), and an open position (A), in which said second filling cam (22) is positioned angularly spaced from said first filling cam (21).

3. Tablet press machine (1) according to any preceding claim, wherein said first channel (25) comprises a first upper track (25a) and a first lower track (25b) and said second channel (26) comprises a second upper track (26a) and a second lower track (26b), said first and second tracks (25a, 25b, 26a, 26b) being configured to abut said follower ends (15) of said lower punches (5).

4. Tablet press machine (1) according to claim 3, wherein said first channel (25) comprises a first section (31) and a second section (32), said first channel (25) in said first section (31) being convergent, having a distance between said first upper and lower tracks (25a, 25b) decreasing in the rotation direction (R), with an inlet height (d1) of said first channel (25) such as to allow said follower ends (15) to abut said first upper track (25a) or said first lower track (25b) and an outlet height (d2) of said first channel (25) such as to maintain said follower ends (15) abutting substantially both the first upper and lower tracks (25a, 25b), said first channel (25) in said second section (32), which is located downstream of said first section (31) with respect to said rotation direction (R), having a distance between said first upper and lower tracks (25a, 25b) that is substantially constant and equal to said outlet height (d2).

5. Tablet press machine (1) according to claim 4, wherein said first upper track (25a) is substantially straight and inclined, and with slope towards said first lower track (25b) in said first section (31), according to the rotation direction (R) and said first lower track (25b) is substantially perpendicular to the rotation axis (X) in said first section (31), while it is inclined with respect to the rotation axis (X) and parallel to said first upper track (25a) in said second section (32).

6. Tablet press machine (1) according to any of claims 3 to 5, wherein said second channel (26) comprises a further first section (33) and a further second section (34), said second channel (26) in said further first section (33) being convergent, having a distance between said second upper and lower tracks (26a, 26b) decreasing in the rotation direction (R) with a further inlet height (d1') of said second channel (26) such as to allow said follower ends (15) to abut said second upper track (26a) or said second lower track (26b) and a further outlet height (d2') of said second channel (26) such as to keep said follower ends (15) abutting substantially both said second upper and lower tracks (26a, 26b), said second channel (26) in said further second section (34), which is located downstream of said further first section (33) with respect to said rotation direction (R), having a distance between said second tracks (26a, 26b) substantially constant and equal to said further output height (d2').

7. Tablet press machine (1) according to claim 6, wherein said second upper track (26a) is substantially straight and inclined, and with slope towards said second lower track (26b) in said further first section (33), according to the rotation direction (R) and said second lower track (26b) is substantially perpendicular to the rotation axis (X) in said further first section (33), while it is inclined with respect to the rotation axis (X) and parallel to said second upper track (26a) in said further second section (34).

8. Tablet press machine (1) according to any of claims 3 to 7, wherein said first upper track (25a) and said second upper track (26a) are inclined with respect to a supporting plane (12a) of said second adjustment element (12) by the same inclination angle (α).

9. Tablet press machine (1) according to any preceding claim, comprising second driving means (14) configured to move by second transmission means (48) said second adjustment element (12) with respect to said first adjustment element (11) along said first direction (T).

10. Tablet press machine (1) according to claim 9, wherein said second driving means (14) are further configured to move by third transmission means (51), in a coordinated manner with respect to said first filling cam (21), said second filling cam (22) slidably on said second adjustment element (12).

11. Tablet press machine (1) according to claim 10, wherein said third transmission means (51) comprise a toothed sector made on said second filling cam (22) and a pinion (52) engaging with each other, said pinion (52) being rotated by said second driving means (14).

12. Tablet press machine (1) according to any preceding claim, wherein said first filling cam (21) is mounted fixed on said first adjustment element (11).

13. Tablet press machine (1) according to any preceding claim, wherein said second adjustment element (12) comprises an outlet track (29) adapted to support and slidably guide said follower ends (15) of said lower punches (5) exiting said second filling cam (22) and having a substantially linear and horizontal profile, a filling distance (F) between upper sliding surfaces of an inlet track (28) located upstream of said first filling cam (21) and said outlet track (29) coinciding with a stroke of said lower punches (5) along said first direction (T) to form said dosing chambers (40) in said dies (4) having a settled filling depth (L1, L2, L3, L4).

14. Tablet press machine (1) according to any preceding claim, wherein said follower end (15) of each lower punch (5) comprises a shaped annular protrusion provided with opposite annular abutting faces (15a, 15b) arranged to slidably abut said channels (25, 26).

Patentansprüche

1. Dreh-Tablettenpressmaschine (1), aufweisend:

- einen Kompressionsrevolver (2), der sich mit einer Drehrichtung (R) um eine Drehachse (X) dreht und einen Matrizentisch (3) beinhaltet, der entlang eines Umfangsabschnitts mit einer Mehrzahl von Matrizen (4), einer Mehrzahl von unteren Stempeln (5) und einer entsprechenden Mehrzahl von oberen Stempeln (6), die paarweise jeweiligen Matrizen (4) zugeordnet sind, versehen ist;
- eine Dosierstation (7), die Füllmittel (8) zum Füllen von Dosierhohlräumen (40) mit einem Produkt (50) aufweist, die von den Matrizen (4) gebildet werden, die am Boden durch die unteren Stempel (5) geschlossen sind und eine festgelegte Fülltiefe (L1, L2, L3, L4) besitzen, und
- Nockenmittel (10), die mit den unteren Stempeln (5) zusammenwirken, um die unteren Stempel innerhalb der jeweiligen Matrizen (4) zu bewegen und die festgelegte Fülltiefe (L1, L2, L3, L4) zu erhalten, wobei die Nockenmittel (10) einen ersten Füllnocken (21), der mit einem ersten Kanal (25) versehen ist, und einen zweiten Füllnocken (22), der mit einem zweiten Kanal (26) versehen ist, aufweisen, wobei der erste Kanal (25) und der zweite Kanal (26) so ausgebildet und gegenseitig angeordnet sind, dass sie Mitnehmerenden (15) der unteren Stempel (5) entlang eines Füllkanals (27) führen;

dadurch gekennzeichnet, dass sie aufweist:

- ein erstes Einstellelement (11), das den ersten Füllnocken (21) trägt, und ein zweites Einstellelement (12), das den zweiten Füllnocken (22) trägt, der auf dem zweiten Einstellelement (12) entlang eines Umfangsbogens um die Drehachse (X) gleitend angebracht ist, wobei das zweite Einstellelement (12) so ausgebildet ist, dass es in Bezug auf das erste Einstellelement (11) entlang einer ersten Richtung (T) parallel zu der Drehachse (X) bewegt werden kann;
- erste Antriebsmittel (13), die so ausgebildet sind, dass sie in Bezug auf den Kompressionsrevolver (2) und entlang der ersten Richtung (T) gleichzeitig das erste Einstellelement (11), das den ersten Füllnocken (21) trägt, und das zweite Einstellelement (12), das den zweiten Füllnocken (22) gleitend trägt, bewegen; und
- zweite Antriebsmittel (14), die so ausgebildet sind, dass sie in Bezug auf den ersten Füllnocken (21) das zweite Einstellelement (12) und den zweiten Füllnocken (22) in koordinierter Weise entlang der ersten Richtung (T) bzw. entlang des zweiten Einstellelements (12) und um die Drehachse (X) bewegen;

wobei der erste Füllnocken (21) und der zweite Füllnocken (22) so ausgebildet sind, dass sie durch die ersten Antriebsmittel (13) und die zweiten Antriebsmittel (14) in Bezug aufeinander so positioniert werden, dass der erste Kanal (25) und der zweite Kanal (26) den Füllkanal (27) bilden, der eine solche Länge und ein solches Profil besitzt, dass er die erforderliche Verschiebung der unteren Stempel (5) ausführt, um die festgelegte Fülltiefe (L1, L2, L3, L4) zu erhalten, und wobei der erste Kanal (25) an einem seiner Enden für den Eintritt des unteren Stempels (5) eine Einlasshöhe (d1) besitzt, die größer ist als eine Arbeitshöhe (h) des Mitnehmerendes (15) des unteren Stempels (5).

2. Tablettenpressmaschine (1) nach Anspruch 1, wobei der zweite Füllnocken (22) zumindest zwischen einer geschlossenen Position (B), in der er dem ersten Füllnocken (21) im Wesentlichen gegenüberliegt, wobei der erste Kanal (25) dem zweiten Kanal (26) zugewandt ist, und einer offenen Position (A), in der der zweite Füllnocken (22) winkelmäßig beabstandet von dem ersten Füllnocken (21) positioniert ist, bewegbar ist.

3. Tablettenpressmaschine (1) nach einem der vorhergehenden Ansprüche, wobei der erste Kanal (25) eine erste obere Bahn (25a) und eine erste untere Bahn (25b) aufweist und der zweite Kanal (26) eine zweite obere Bahn (26a) und eine zweite untere Bahn (26b) aufweist, wobei die ersten und zweiten Bahnen (25a, 25b, 26a, 26b) so ausgebildet sind, dass sie an den Mitnehmerenden (15) der unteren Stempel (5) anliegen.

4. Tablettenpressmaschine (1) nach Anspruch 3, wobei der erste Kanal (25) einen ersten Abschnitt (31) und einen zweiten Abschnitt (32) aufweist, wobei der erste Kanal (25) in dem ersten Abschnitt (31) konvergent ist und einen Abstand zwischen der ersten oberen und unteren Bahn (25a, 25b) besitzt, der in der Drehrichtung (R) abnimmt, mit einer Einlasshöhe (d1) des ersten Kanals (25), so dass die Mitnehmerenden (15) an der ersten oberen Bahn (25a) oder der ersten unteren Bahn (25b) anliegen können, und einer Auslasshöhe (d2) des ersten Kanals (25), so dass die Mitnehmerenden (15) im Wesentlichen sowohl an der ersten oberen als auch an der ersten unteren Bahn (25a, 25b) anliegen, wobei der erste Kanal (25) in dem zweiten Abschnitt (32), der in Bezug auf die Drehrichtung (R) stromabwärts des ersten Abschnitts (31) angeordnet ist, einen Abstand zwischen der ersten oberen und der ersten unteren Bahn (25a, 25b) besitzt, der im Wesentlichen konstant und gleich der Auslasshöhe (d2) ist.

5. Tablettenpressmaschine (1) nach Anspruch 4, wobei die erste obere Bahn (25a) im Wesentlichen gerade und geneigt ist, und mit einer Neigung in Richtung der ersten unteren Bahn (25b) in dem ersten Abschnitt (31) gemäß der Drehrichtung (R), und die erste untere Bahn (25b) in dem ersten Abschnitt (31) im Wesentlichen senkrecht zu der Drehachse (X) ist, während sie in dem zweiten Abschnitt (32) in Bezug auf die Drehachse (X) geneigt und parallel zu der ersten oberen Bahn (25a) ist.

6. Tablettenpressmaschine (1) nach einem der Ansprüche 3 bis 5, wobei der zweite Kanal (26) einen weiteren ersten Abschnitt (33) und einen weiteren zweiten Abschnitt (34) aufweist, wobei der zweite Kanal (26) in dem weiteren ersten Abschnitt (33) konvergent ist und einen Abstand zwischen der zweiten oberen und unteren Bahn (26a, 26b) besitzt, der in der Drehrichtung (R) abnimmt, mit einer weiteren Einlasshöhe (d1') des zweiten Kanals (26), so dass die Mitnehmerenden (15) an der zweiten oberen Bahn (26a) oder der zweiten unteren Bahn (26b) anliegen können, und einer weiteren Auslasshöhe (d2') des zweiten Kanals (26), so dass die Mitnehmerenden (15) im Wesentlichen sowohl an der zweiten oberen als auch an der zweiten unteren Bahn (26a, 26b) anliegen, wobei der zweite Kanal (26) in dem weiteren zweiten Abschnitt (34), der in Bezug auf die Drehrichtung (R) stromabwärts des weiteren ersten Abschnitts (33) angeordnet ist, einen Abstand zwischen den zweiten Bahnen (26a, 26b) besitzt, der im Wesentlichen konstant und gleich der weiteren Auslasshöhe (d2') ist.

7. Tablettenpressmaschine (1) nach Anspruch 6, wobei die zweite obere Bahn (26a) im Wesentlichen gerade und geneigt ist, und mit einer Neigung in Richtung der zweiten unteren Bahn (26b) in dem weiteren ersten Abschnitt (33), gemäß der Drehrichtung (R), und die zweite untere Bahn (26b) in dem weiteren ersten Abschnitt (33) im Wesentlichen senkrecht zu der Drehachse (X) ist, während sie in dem weiteren zweiten Abschnitt (34) in Bezug auf die Drehachse (X) geneigt und parallel zu der zweiten oberen Bahn (26a) ist.

8. Tablettenpressmaschine (1) nach einem der Ansprüche 3 bis 7, wobei die erste obere Bahn (25a) und die zweite obere Bahn (26a) in Bezug auf eine Stützebene (12a) des zweiten Einstellelements (12) um den selben Neigungswinkel (α) geneigt sind.

9. Tablettenpressmaschine (1) nach einem der vorhergehenden Ansprüche, aufweisend zweite Antriebsmittel (14), die so ausgebildet sind, dass sie durch zweite Übertragungsmittel (48) das zweite Einstellelement (12) in Bezug auf das erste Einstellelement (11) entlang der ersten Richtung (T) bewegen.

10. Tablettenpressmaschine (1) nach Anspruch 9, wobei die zweiten Antriebsmittel (14) zudem so ausgebildet sind, dass sie durch dritte Übertragungsmittel

(51) in einer koordinierten Weise in Bezug auf den ersten Füllnocken (21) den zweiten Füllnocken (22) gleitend auf dem zweiten Einstellelement (12) bewegen.

11. Tablettenpressmaschine (1) nach Anspruch 10, wobei die dritten Übertragungsmittel (51) einen an dem zweiten Füllnocken (22) ausgebildeten Zahnsektor und ein Ritzel (52) aufweisen, die miteinander in Eingriff stehen, wobei das Ritzel (52) durch die zweiten Antriebsmittel (14) gedreht wird.

12. Tablettenpressmaschine (1) nach einem der vorhergehenden Ansprüche, wobei der erste Füllnocken (21) fest an dem ersten Einstellelement (11) angebracht ist.

13. Tablettenpressmaschine (1) nach einem der vorhergehenden Ansprüche, wobei das zweite Einstellelement (12) eine Auslassbahn (29) aufweist, die ausgebildet ist, die aus dem zweiten Füllnocken (22) austretenden Mitnehmerenden (15) der unteren Stempel (5) zu tragen und gleitend zu führen, und die ein im Wesentlichen lineares und horizontales Profil aufweist, wobei ein Füllabstand (F) zwischen oberen Gleitflächen einer Einlassbahn (28), die stromaufwärts des ersten Füllnockens (21) angeordnet ist, und der Auslassbahn (29), mit einem Hub der unteren Stempel (5) entlang der ersten Richtung (T) zusammenfällt, um die Dosierkammern (40) in den Matrizen (4) mit einer festgelegten Fülltiefe (L1, L2, L3, L4) zu bilden.

14. Tablettenpressmaschine (1) nach einem der vorhergehenden Ansprüche, wobei das Mitnehmerende (15) jedes unteren Stempels (5) einen geformten ringförmigen Vorsprung aufweist, der mit gegenüberliegenden ringförmigen Anschlagflächen (15a, 15b) versehen ist, die so angeordnet sind, dass sie gleitend an den Kanälen (25, 26) anliegen.

Revendications

1. Presse à comprimés (1) rotative comprenant :

- une tourelle de compression (2) en rotation avec une direction de rotation (R) autour d'un axe de rotation (X) et comportant une table à matrices (3), dotée le long d'une partie circonférentielle de celle-ci d'une pluralité de matrices (4), une pluralité de poinçons inférieurs (5) et une pluralité correspondante de poinçons supérieurs (6) associés par paires à des matrices (4) respectives ;
- une station de dosage (7) comprenant des moyens de remplissage (8) pour remplir d'un produit (50) des cavités de dosage (40) qui sont formées par lesdites matrices (4) fermées au fond par lesdits poinçons inférieurs (5) et ont une profondeur de remplissage fixée (L1, L2, L3, L4) et
- des moyens de cames (10) coopérant avec lesdits poinçons inférieurs (5) pour bouger les poinçons inférieurs à l'intérieur des matrices (4) respectives et obtenir ladite profondeur de remplissage fixée (L1, L2, L3, L4), dans laquelle lesdits moyens de cames (10) comprennent une première came de remplissage (21) dotée d'un premier canal (25) et une deuxième came de remplissage (22) dotée d'un deuxième canal (26), ledit premier canal (25) et ledit deuxième canal (26) étant configurés et agencés mutuellement pour guider des extrémités de suiveur (15) desdits poinçons inférieurs (5) le long d'un canal de remplissage (27) ;

caractérisée en ce qu'elle comprend :

- un premier élément de réglage (11) supportant ladite première came de remplissage (21) et un deuxième élément de réglage (12) supportant ladite deuxième came de remplissage (22), qui est montée sur ledit deuxième élément de réglage (12) de manière coulissante le long d'un arc de circonférence autour dudit axe de rotation (X), ledit deuxième élément de réglage (12) étant configuré pour être bougé par rapport audit premier élément de réglage (11) le long d'une première direction (T) parallèle audit axe de rotation (X) ;

des premiers moyens d'entraînement (13) configurés pour bouger par rapport à ladite tourelle de compression (2) et le long de ladite première direction (T) simultanément ledit premier élément de réglage (11) supportant ladite première came de remplissage (21) et ledit deuxième élément de réglage (12) supportant de manière coulissante ladite deuxième came de remplissage (22) ; et

- des deuxièmes moyens d'entraînement (14) configurés pour bouger, par rapport à ladite première came de remplissage (21), ledit deuxième élément de réglage (12) et ladite deuxième came de remplissage (22) d'une manière coordonnée respectivement le long de la première direction (T) et le long du deuxième élément de réglage (12) et autour dudit axe de rotation (X) ;

dans laquelle ladite première came de remplissage (21) et ladite deuxième came de remplissage (22) sont configurées pour être positionnées l'une par rapport à l'autre par lesdits premiers moyens d'entraînement (13) et lesdits deuxièmes moyens d'entraînement (14) de sorte que ledit premier canal (25) et ledit deuxième canal (26) forment ledit canal de remplissage (27) ayant une longueur et un profil tels qu'il mène à bien le déplacement requis des poinçons inférieurs (5) pour obtenir ladite profondeur de remplissage fixée (L1, L2, L3, L4) et dans laquelle ledit premier canal (25) à une extrémité de celui-ci pour l'entrée du poinçon inférieur (5) a une hauteur d'admission (d1) plus grande qu'une hauteur de fonctionnement (h) de ladite extrémité de suiveur (15) du poinçon inférieur (5).

2. Presse à comprimés (1) selon la revendication 1, dans laquelle ladite deuxième came de remplissage (22) est mobile au moins entre une position fermée (B), dans laquelle elle est sensiblement opposée à ladite première came de remplissage (21) avec le premier canal (25) faisant face au deuxième canal (26), et une position ouverte (A), dans laquelle ladite deuxième came de remplissage (22) est positionnée espacée angulairement de ladite première came de remplissage (21).

3. Presse à comprimés (1) selon une quelconque revendication précédente, dans laquelle ledit premier canal (25) comprend une première piste (25a) supérieure et une première piste (25b) inférieure et ledit deuxième canal (26) comprend une deuxième piste (26a) supérieure et une deuxième piste (26b) inférieure, lesdites premières et deuxièmes pistes (25a, 25b, 26a, 26b) étant configurées pour buter contre lesdites extrémités de suiveur (15) desdits poinçons inférieurs (5).

4. Presse à comprimés (1) selon la revendication 3, dans laquelle ledit premier canal (25) comprend une première section (31) et une deuxième section (32), ledit premier canal (25) dans ladite première section (31) étant convergent, ayant une distance entre lesdites premières pistes (25a, 25b) supérieure et inférieure diminuant dans la direction de rotation (R), avec une hauteur d'admission (d1) dudit premier canal (25) telle qu'elle permet auxdites extrémités de suiveur (15) de buter contre ladite première piste (25a) supérieure ou ladite première piste (25b) inférieure et une hauteur d'évacuation (d2) dudit premier canal (25) telle qu'elle maintient lesdites extrémités de suiveur (15) en butée contre sensiblement à la fois les premières pistes (25a, 25b) supérieure et inférieure, ledit premier canal (25) dans ladite deuxième section (32), qui est située en aval de ladite première section (31) par rapport à ladite direction de rotation (R), ayant une distance entre lesdites premières pistes (25a, 25b) supérieure et inférieure qui est sensiblement constante et égale à ladite hauteur d'évacuation (d2).

5. Presse à comprimés (1) selon la revendication 4, dans laquelle ladite première piste (25a) supérieure est sensiblement droite et inclinée, et avec une pente vers ladite première piste (25b) inférieure dans ladite première direction (31), conformément à la direction de rotation (R) et ladite première piste (25b) inférieure est sensiblement perpendiculaire à l'axe de rotation (X) dans ladite première section (31), tandis qu'elle est inclinée par rapport à l'axe de rotation (X) et parallèle à ladite première piste (25a) supérieure dans ladite deuxième section (32).

6. Presse à comprimés (1) selon l'une quelconque des revendications 3 à 5, dans laquelle ledit deuxième canal (26) comprend une autre première section (33) et une autre deuxième section (34), ledit deuxième canal (26) dans ladite autre première section (33) étant convergent, ayant une distance entre lesdites deuxièmes pistes (26a, 26b) supérieure et inférieure diminuant dans la direction de rotation (R) avec une autre hauteur d'admission (d1') dudit deuxième canal (26) telle qu'elle permet auxdites extrémités de suiveur (15) de buter contre ladite deuxième piste (26a) supérieure ou ladite deuxième piste (26b) inférieure et une autre hauteur (d2') d'évacuation dudit deuxième canal (26) telle qu'elle garde lesdites extrémités de suiveur (15) en butée contre sensiblement à la fois lesdites deuxièmes pistes (26a, 26b) supérieure et inférieure, ledit deuxième canal (26) dans ladite autre deuxième section (34), qui est située en aval de ladite autre première section (33) par rapport à ladite direction de rotation (R), ayant une distance entre lesdites deuxièmes pistes (26a, 26b) sensiblement constante et égale à ladite autre hauteur (d2') de sortie.

7. Presse à comprimés (1) selon la revendication 6, dans laquelle ladite deuxième piste (26a) supérieure est sensiblement droite et inclinée, et avec une pente vers ladite deuxième piste (26b) inférieure dans ladite autre première section (33), conformément à la direction de rotation (R) et ladite deuxième piste (26b) inférieure est sensiblement perpendiculaire à l'axe de rotation (X) dans ladite autre première section (33), tandis qu'elle est inclinée par rapport à l'axe de rotation (X) et parallèle à ladite deuxième piste (26a) supérieure dans ladite autre deuxième section (34).

8. Presse à comprimés (1) selon l'une quelconque des revendications 3 à 7, dans laquelle ladite première piste (25a) supérieure et ladite deuxième piste (26a) supérieure sont inclinées par rapport à un plan de support (12a) dudit deuxième élément de réglage (12) selon le même angle d'inclinaison (α).

9. Presse à comprimés (1) selon une quelconque revendication précédente, comprenant des deuxièmes moyens d'entraînement (14) configurés pour faire bouger par des deuxièmes moyens de transmission (48) ledit deuxième élément de réglage (12) par rapport audit premier élément de réglage (11) le long de ladite première direction (T).

10. Presse à comprimés (1) selon la revendication 9, dans laquelle lesdits deuxièmes moyens d'entraînement (14) sont en outre configurés pour faire bouger par des troisièmes moyens de transmission (51), d'une manière coordonnée par rapport à ladite première came de remplissage (21), ladite deuxième came de remplissage (22) de manière coulissante sur ledit deuxième élément de réglage (12).

11. Presse à comprimés (1) selon la revendication 10, dans laquelle lesdits troisièmes moyens de transmission (51) comprennent un secteur denté fait sur ladite deuxième came de remplissage (22) et un pignon (52) venant en prise l'un avec l'autre, ledit pignon (52) étant mis en rotation par lesdits deuxièmes moyens d'entraînement (14).

12. Presse à comprimés (1) selon une quelconque revendication précédente, dans laquelle ladite première came de remplissage (21) est montée fixe sur ledit premier élément de réglage (11).

13. Presse à comprimés (1) selon une quelconque revendication précédente, dans laquelle ledit deuxième élément de réglage (12) comprend une piste d'évacuation (29) adaptée pour supporter et guider de manière coulissante lesdites extrémités de suiveur (15) desdits poinçons inférieurs (5) sortant de ladite deuxième came de remplissage (22) et ayant un profil sensiblement linéaire et horizontal, une distance de remplissage (F) entre des surfaces coulissantes supérieures d'une piste d'admission (28) située en aval de ladite première came de remplissage (21) et ladite piste d'évacuation (29) coïncidant avec une course desdits poinçons inférieurs (5) le long de ladite première direction (T) pour former lesdites chambres de dosage (40) dans lesdites matrices (4) ayant une profondeur de remplissage fixée (L1, L2, L3, L4).

14. Presse à comprimés (1) selon une quelconque revendication précédente, dans laquelle ladite extrémité de suiveur (15) de chaque poinçon inférieur (5) comprend une saillie annulaire profilée dotée de faces en butée annulaires (15a, 15b) opposées agencées pour buter de manière coulissante contre lesdits canaux (25, 26).

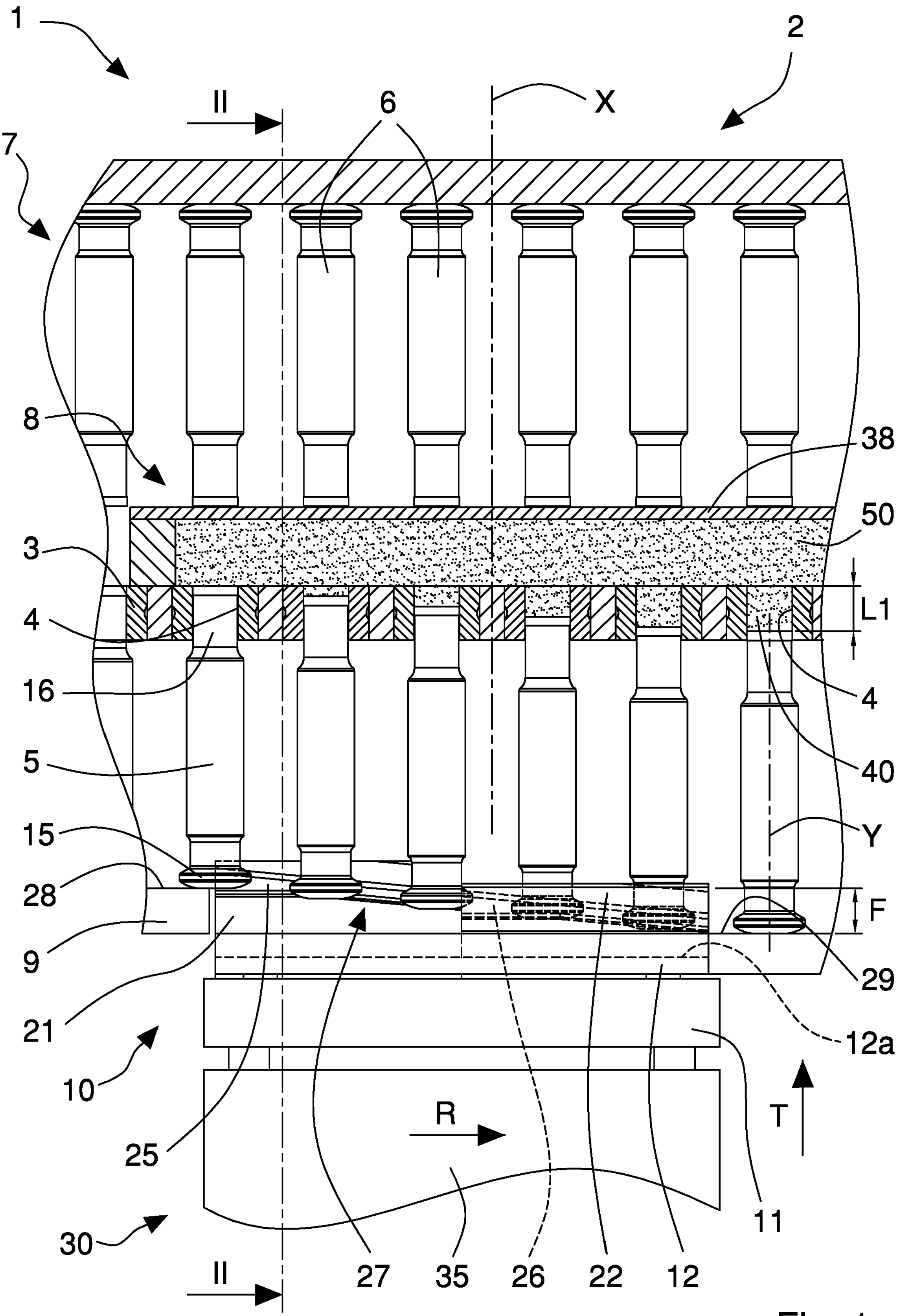

1
2
II
6
X
7
8
38
50
3
L1
4
16
4
5
40
15
Y
28
F
9
29
21
12a
10
T
R
25
11
30
II
27
35
26
22
12

Fig. 1

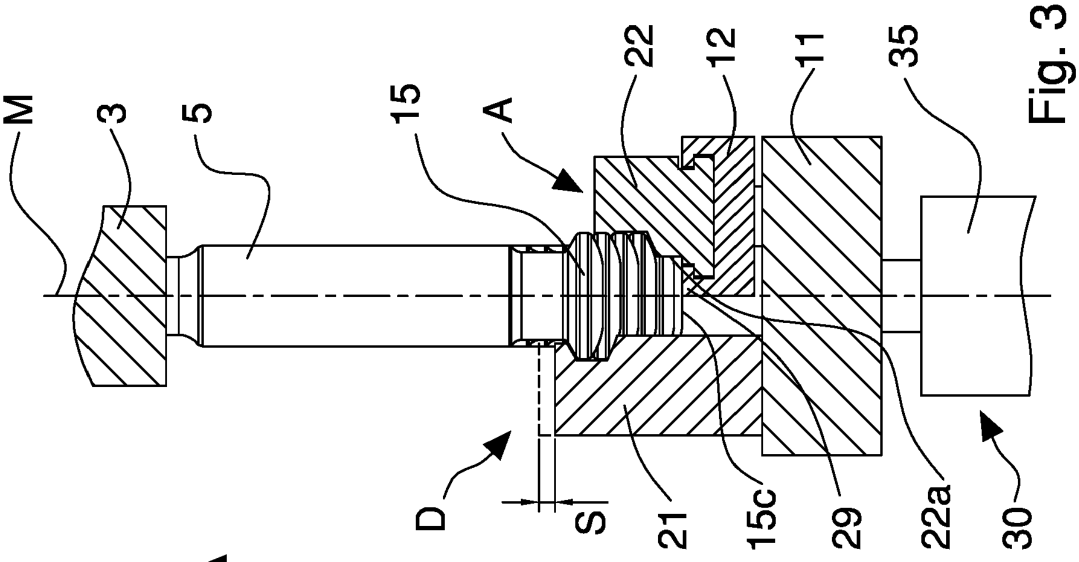

M
3
5
15
A
22
12
11
35
D
S
21
15c
29
22a
30

Fig. 3

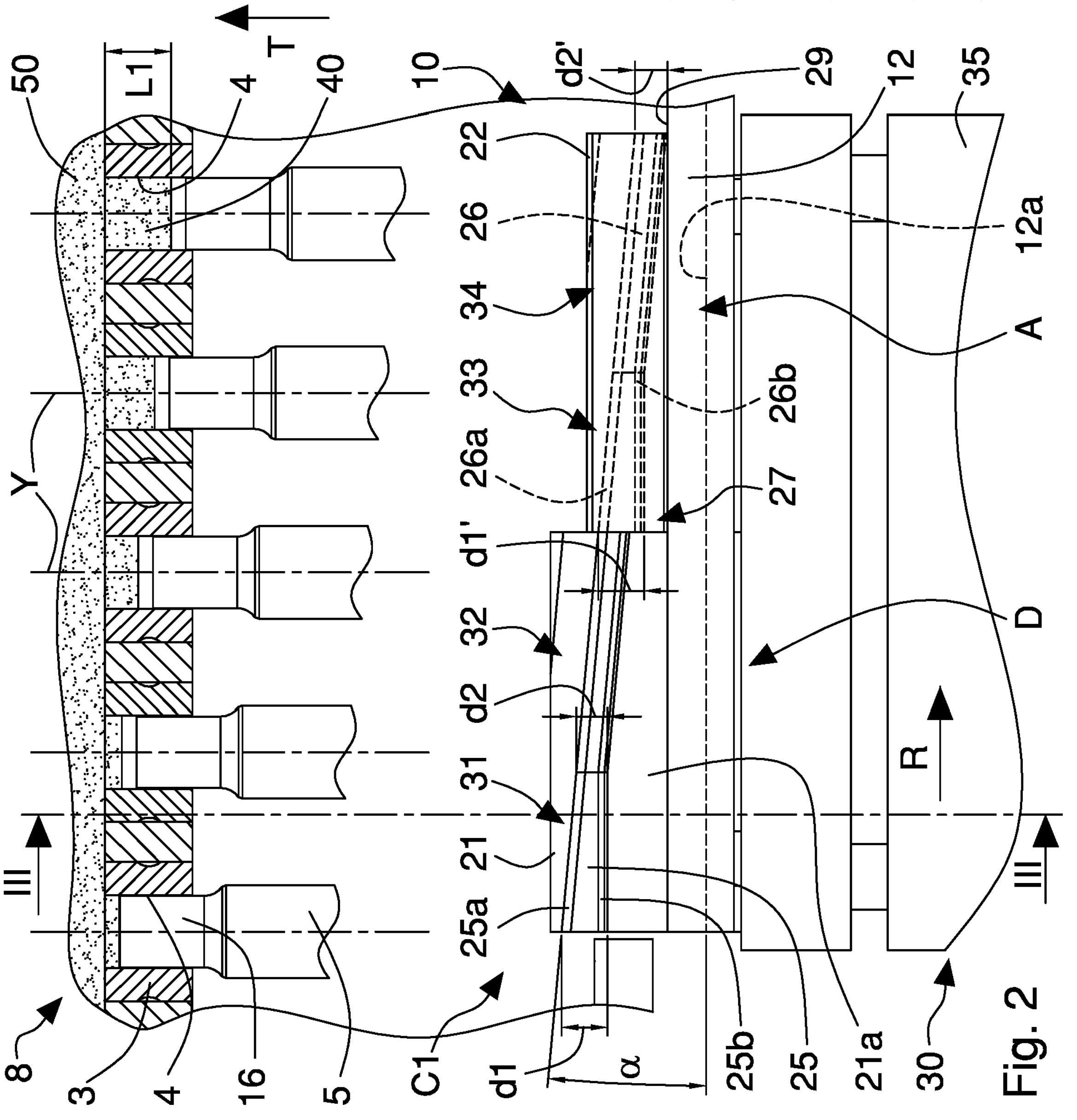

8
3
4
16
5
C1
d1
α
25b
25
21a
30
III
25a
21
31
d2
32
d1'
26a
33
26b
34
26
22
d2'
29
12
35
12a
A
27
D
R
III
Y
50
L1
4
40
T
10

Fig. 2

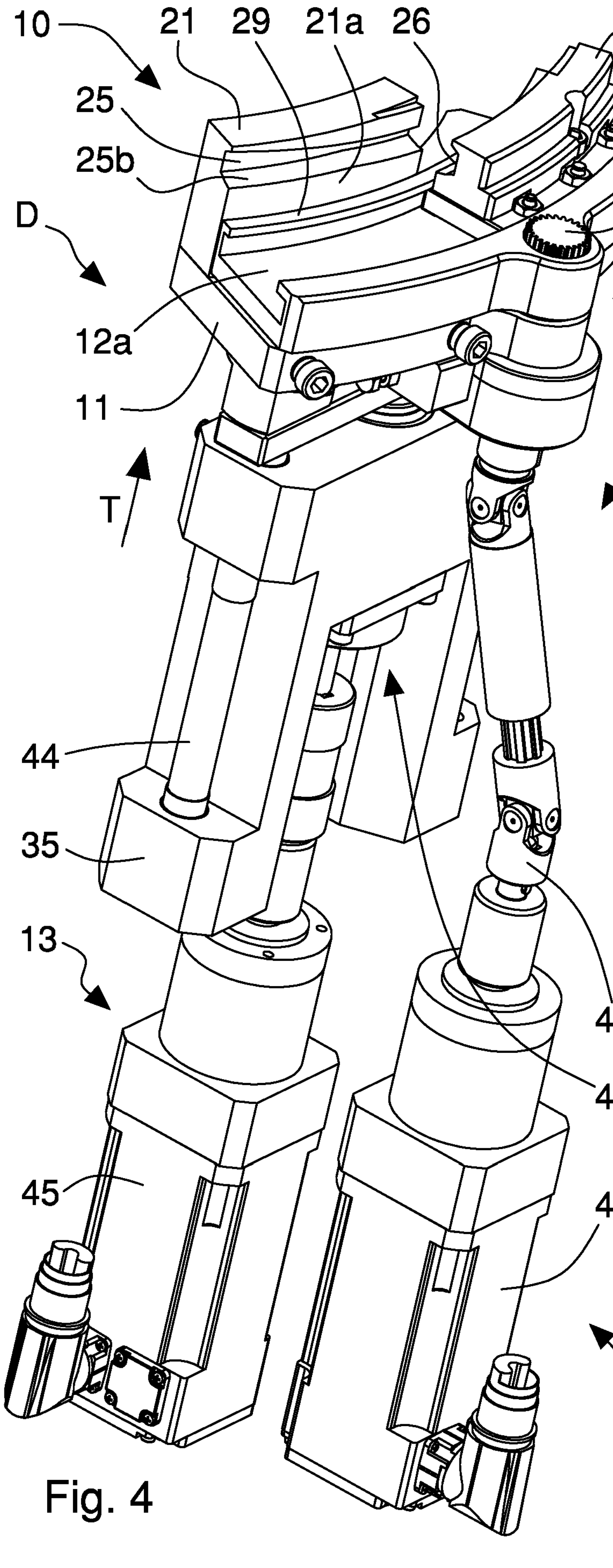

10
21
29
21a
26
22
A
25
25b
12
C1
52
D
51
12a
11
48
T
44
35
13
45
47
49
41
14

Fig. 4

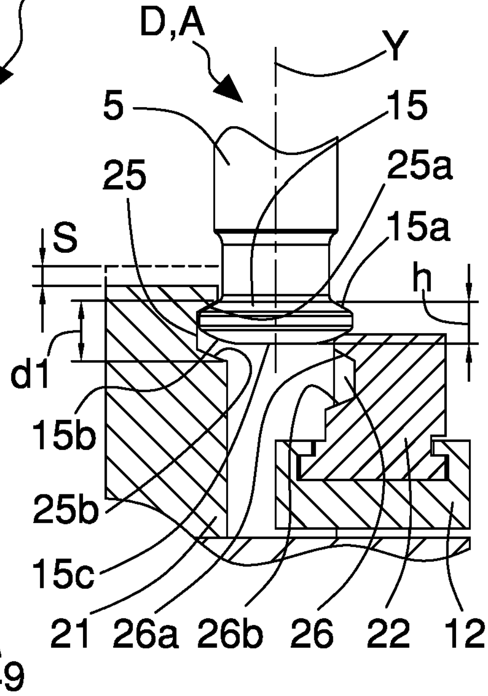

D,A
Y
5
15
25
25a
S
15a
h
d1
15b
25b
15c
21
26a
26b
26
22
12

Fig. 3A

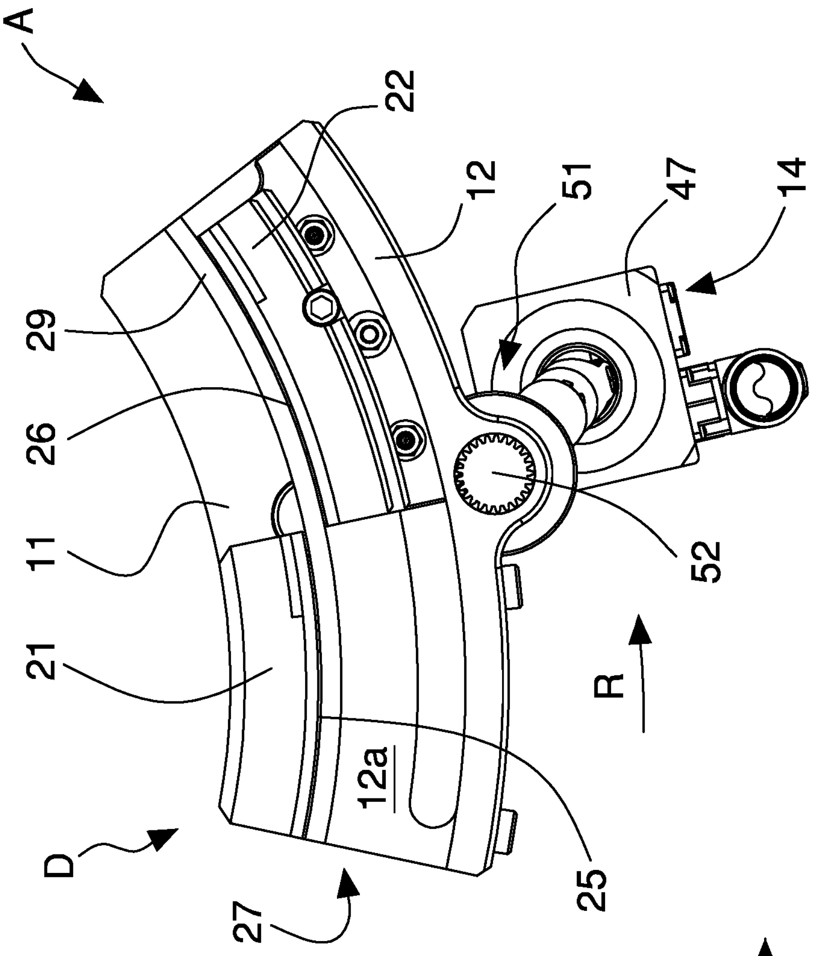

A
22
12
51
47
14
29
26
11
21
52
R
12a
D
27
25

Fig. 6

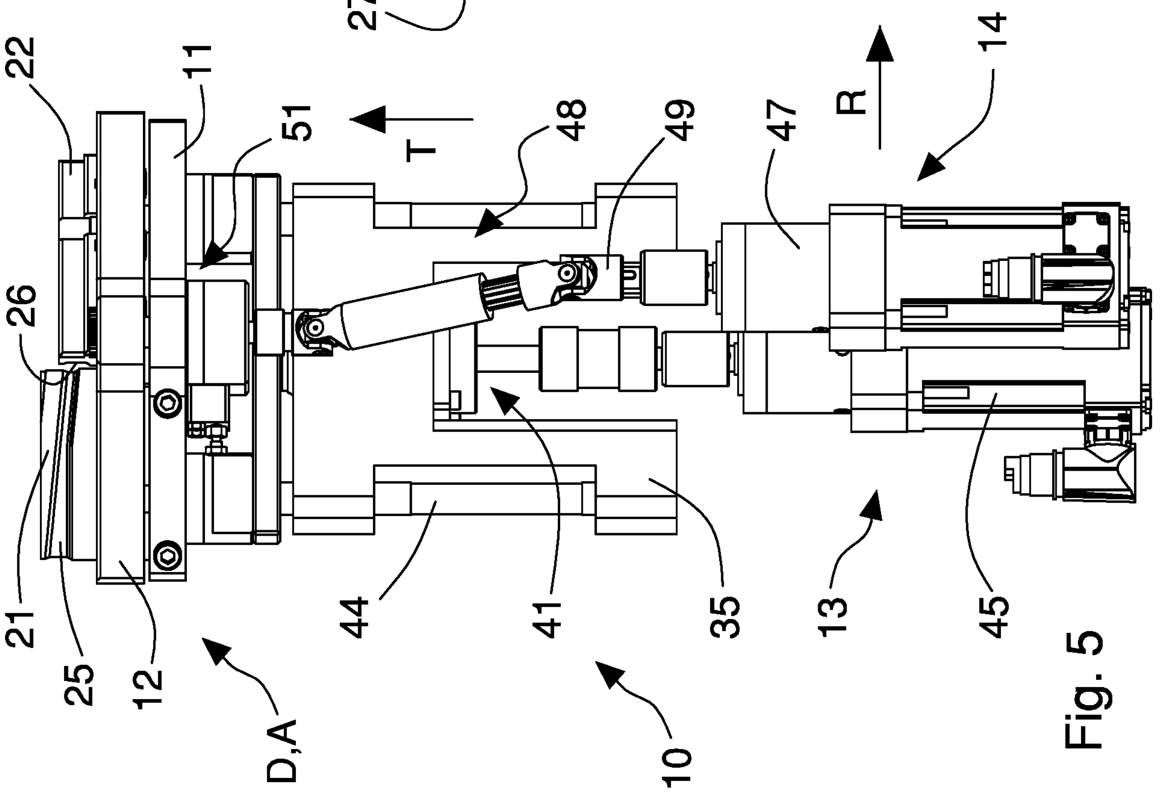

22
26
11
51
T
48
49
47
R
14
21
25
12
D,A
44
41
35
13
45
10

Fig. 5

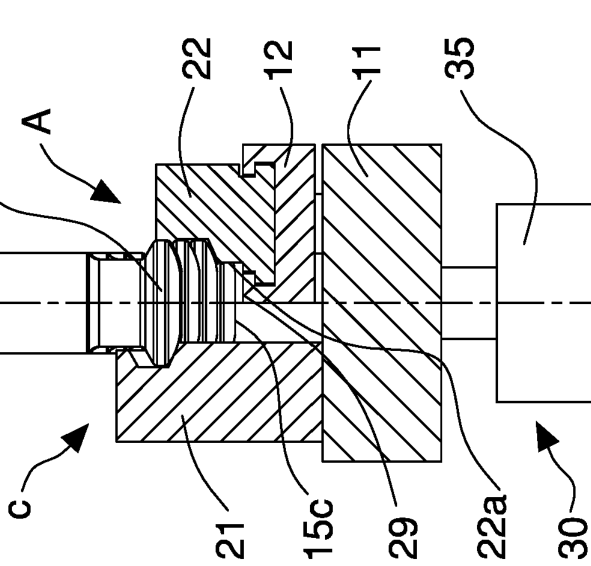

M
3
5
15
A
22
12
11
35
c
21
15c
29
22a
30

Fig. 8

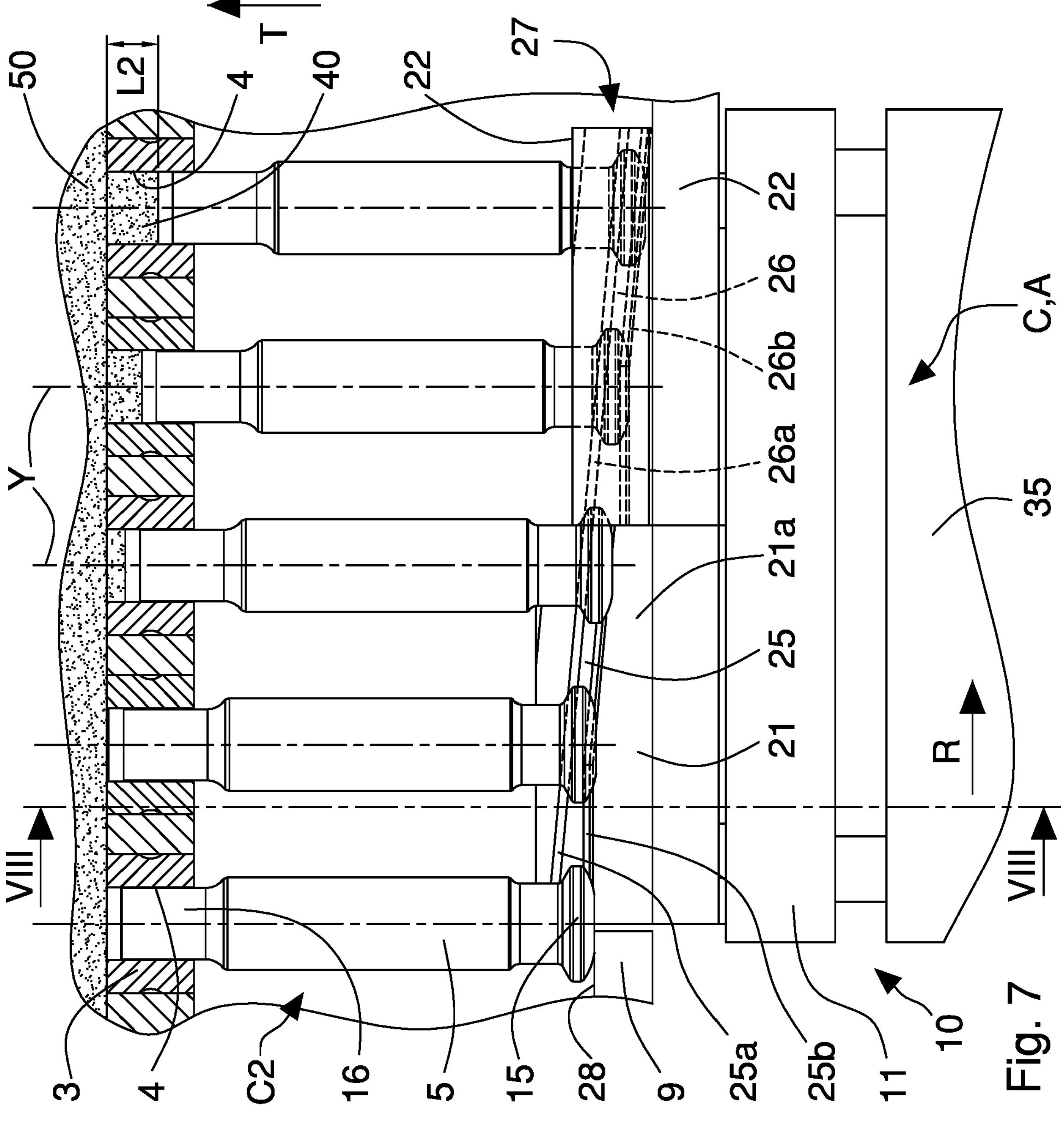

50
L2
4
40
T
22
27
22
26
26b
26a
Y
21a
25
21
VIII
VIII
R
35
C,A
3
4
C2
16
5
15
28
9
25a
25b
11
10

Fig. 7

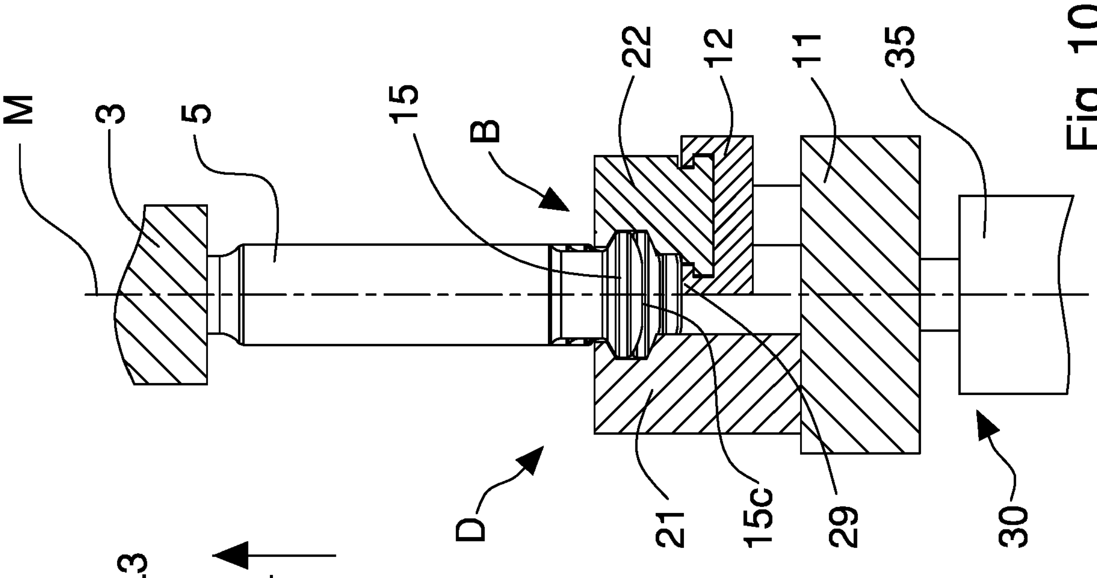

M
3
5
15
B
22
12
11
35
D
21
15c
29
30

Fig. 10

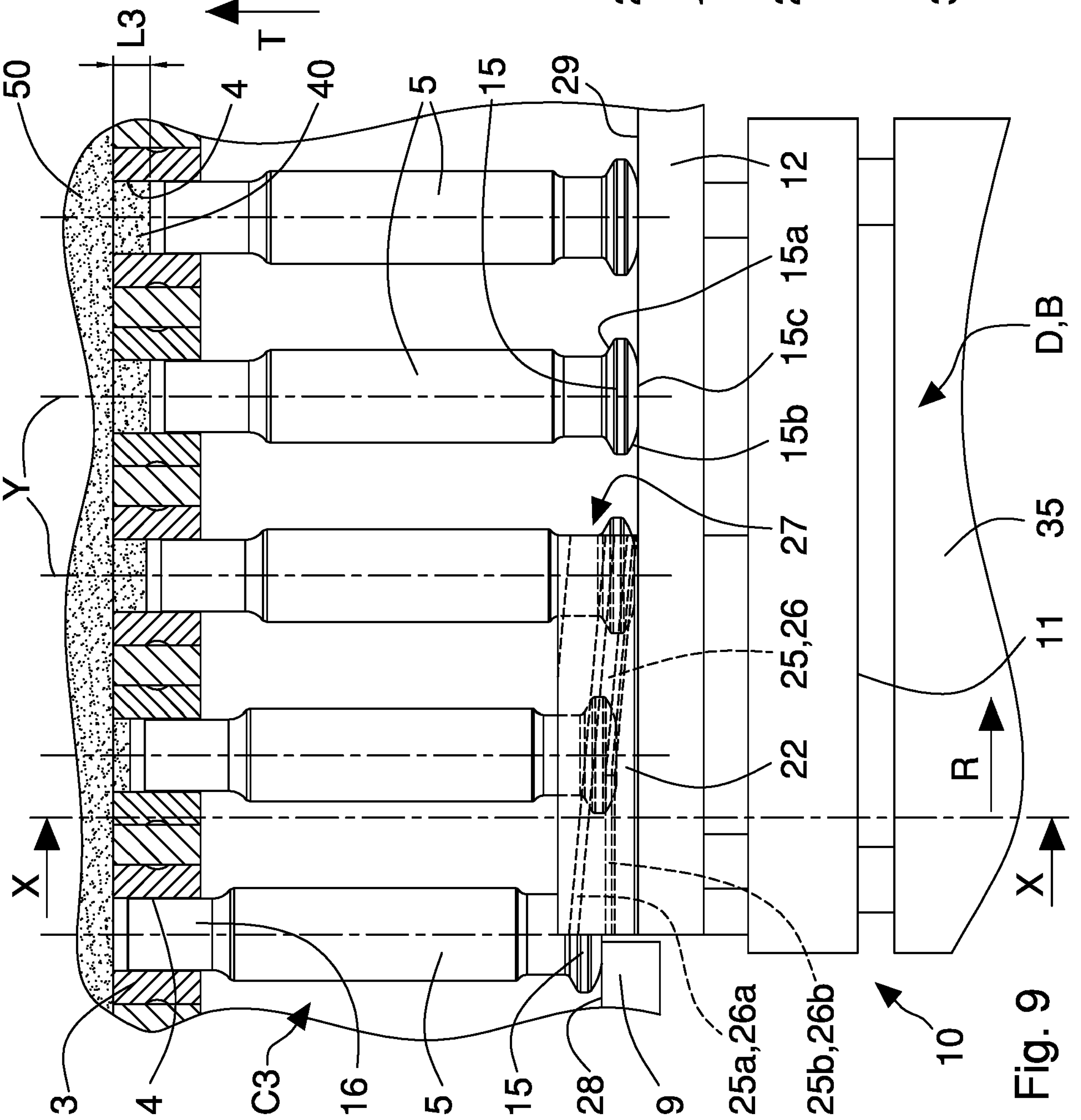

50
L3
T
4
40
5
15
29
12
15a
15c
15b
27
25,26
22
11
35
D,B
R
X
Y
3
4
C3
16
5
15
28
9
25a,26a
25b,26b
10

Fig. 9

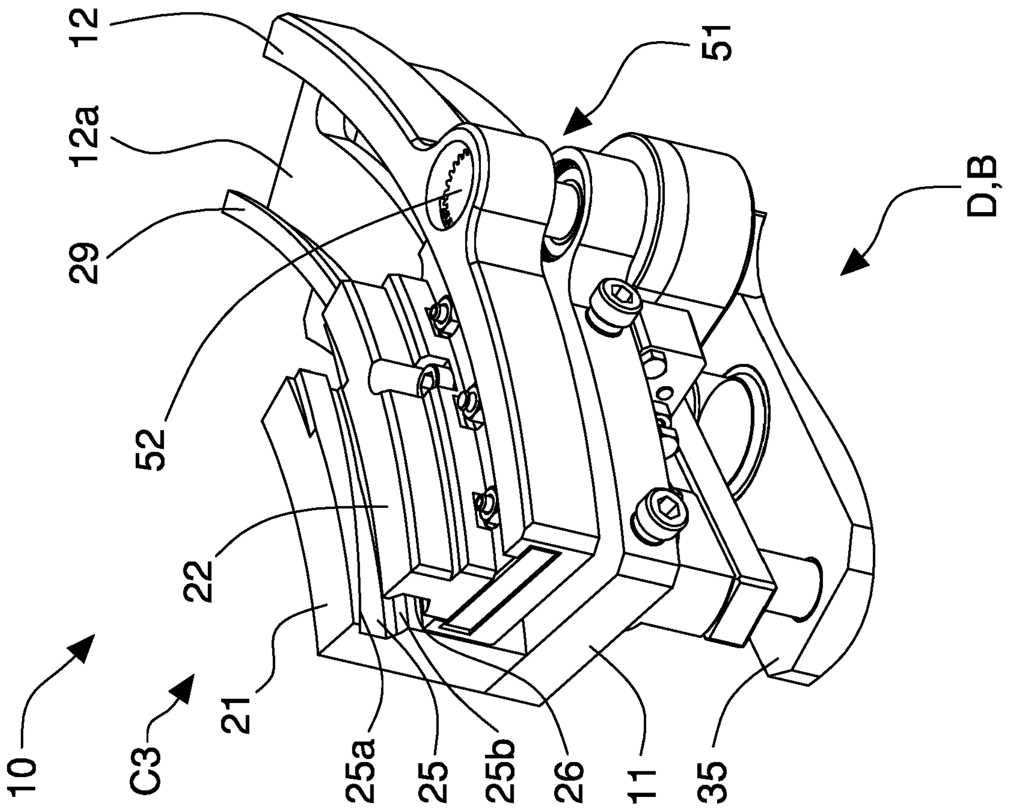

10
C3
21
25a
25
25b
26
11
35
22
52
29
12a
12
51
D,B

Fig. 11

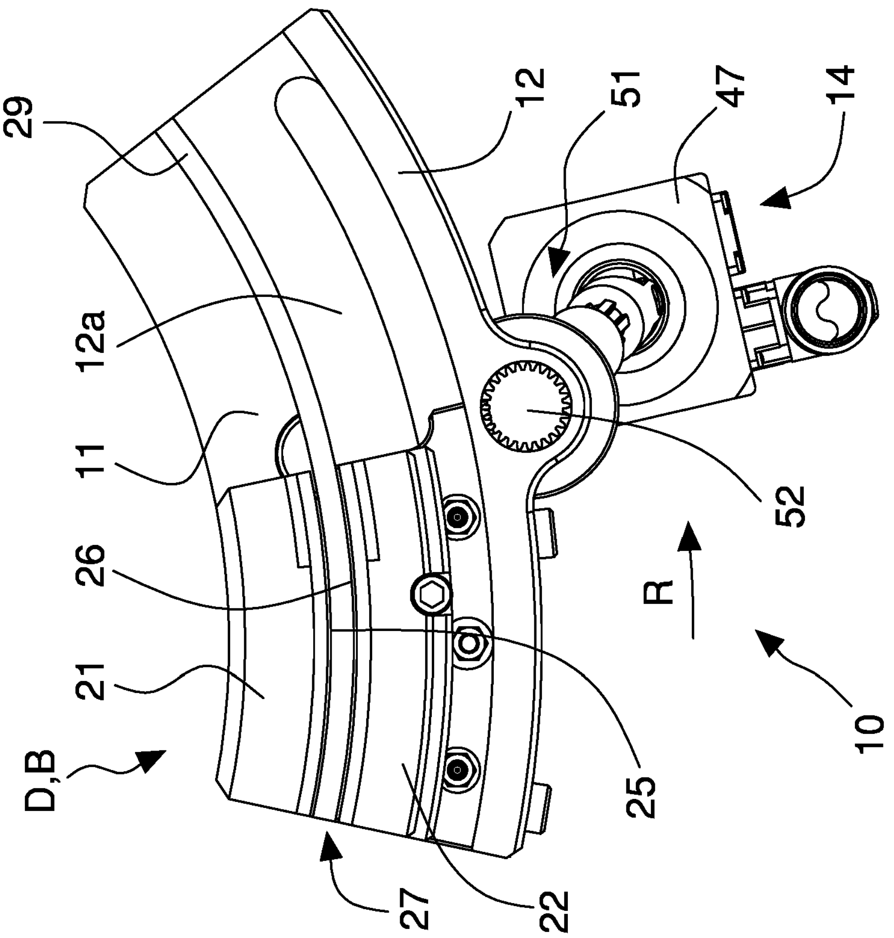
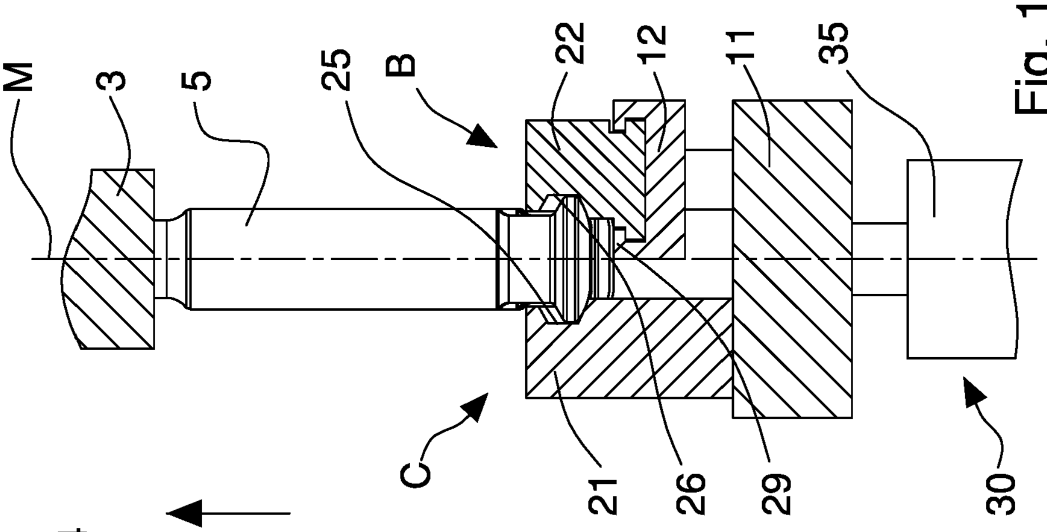
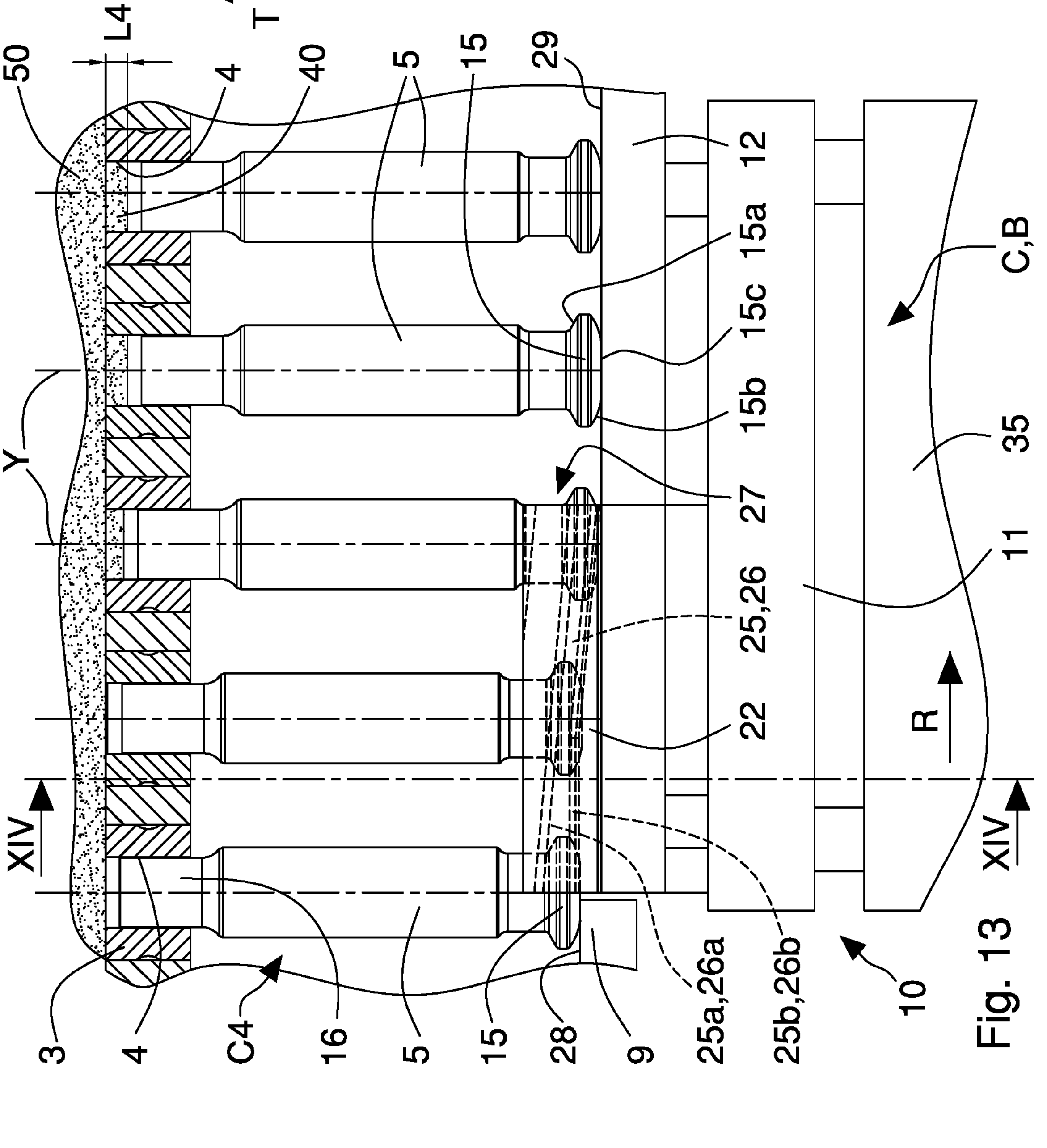

29
12a
11
26
21
D,B
27
22
25
10
R
52
12
51
47
14

Fig. 12



M
3
5
25
B
22
12
11
35
C
21
26
29
30

Fig. 14



50
L4
T
4
40
5
15
29
12
15a
15c
15b
C,B
Y
27
35
11
25,26
22
R
XIV
XIV
3
4
C4
16
5
15
28
9
25a,26a
25b,26b
10

Fig. 13

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5762978 A **[0014]**
- US 2007257411 A **[0015]**